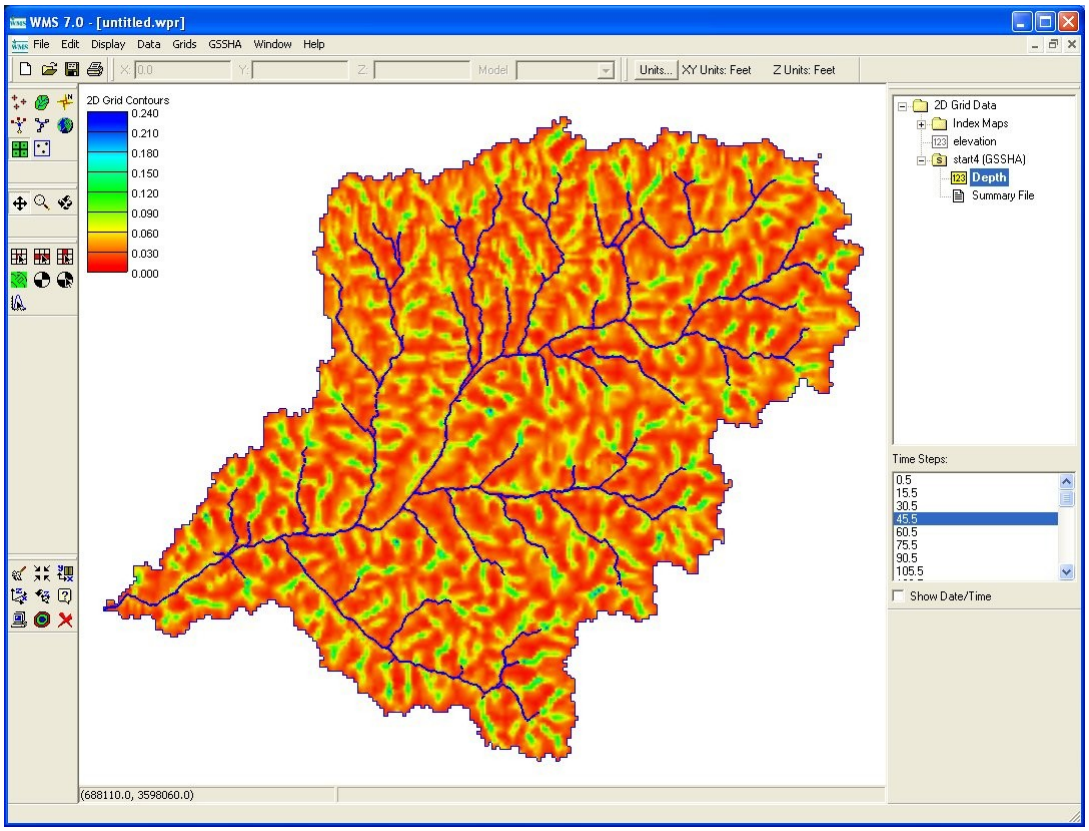
US Army Corps of Engineers®
Engineer Research and Development Center

Watershed Modeling and Analysis

Description

Experts in watershed engineering at the Coastal and Hydraulics Laboratory conduct studies for USACE Districts, municipalities throughout the country, and other Federal and non-Federal agencies using numeric models. Cities and towns throughout the Nation deal with the problems of urban flooding, stream erosion, and non-point source pollution on a daily basis. These problems occur from urban runoff, construction activities, hydrologic modifications, and forestry, mining, and agricultural practices and involve serious economic and environmental issues. CHL's studies are therefore complex, involving atmospheric, land based, wetland, riverine, and coastal systems. Management of these problems requires an integrated knowledge of the systems involved as well as quantitative analysis and predictive capability.



GSSHA simulation of rainfall event's surface water depth

Capabilities

Studies at CHL involving watershed modeling and analysis integrate hydrology, hydraulics, and water quality to help civil engineers and others involved in hydrodynamic modeling make informed decisions about watershed management. A variety of models are used to provide a complete analysis of the water as it cycles through and off the watershed. These models range from more traditional models to newer multidimensional models. Many watersheds have complex hydrologic interactions that make multidimensional

models that tightly couple overland, surface, and subsurface flow a necessity for successful watershed simulation.

Supporting Technology

The tools available at CHL form the basis of a total watershed model that can be linked to other models such as ecosystem and habitat models. CHL is actively developing the multidimensional hydrologic model Gridded Surface Subsurface Hydrologic Analysis (GSSHA) for use in predicting runoff, stream flows, groundwater flows, and soil moisture levels throughout the watershed for use in water resources engineering applications. The Watershed Modeling System (WMS) has been developed to provide a broad integration of the data sources and various hydrologic and hydraulic models for use in system-wide watershed scenarios and allows for the visualization of results from two or more sources that may be linked together to provide different data. Studies at CHL make use of WMS as an interface for several programs including GSSHA, Hydrologic Simulation Program (HSPF), FORTRAN, CE-QUAL-W2, HEC-RAS, HEC-1, and HYDRAIN.

Benefits

CHL's watershed modeling studies using WMS dramatically shorten the time needed for both data acquiring and data assimilation and conversion into usable model inputs. Often the choice of a hydrologic model for a project is based on a user's knowledge of the model and ability to successfully set up a simulation rather than needed capabilities of the model. The conceptual model approach that CHL uses in WMS facilitates moving from model to model without dramatic changes in input and setup time. Users thus have a common base to start from when building any hydrologic model, from simple to complex. The common interface also allows hydrologic models to quickly be linked to hydraulic models such as HEC-RAS and CE-QUAL-W2, enabling rapid system-wide scenarios to be created. This same conceptual approach allows for complex models to be quickly set up in less time than it would take to apply simpler models without WMS.

Success Stories

- Experts from CHL and the U.S. Army Cold Region Research and Engineering Laboratory (CRREL) used WMS to model runoff from the Sava River Basin in Bosnia for the U.S. Department of Defense. CHL and CRREL successfully used WMS to model the Sava River watershed, which encompasses an area of over 34,000 square miles. The model was used to help forecast runoff, and the river stage in the areas where troops are located and pontoon bridges have been constructed. WMS was used in determining sub-basin areas, channel lengths and slopes, flow distances which can be used to develop time area curves, snow melt elevation zones, and other geometric parameters pertinent to an HEC-1 analysis.

- CHL created the Fort Hood Soil Moisture Modeling System for DoD using WMS and GSSHA. A server in WMS was set up for weather data each day and fed into GSSHA to provide the daily moisture profile. The result was a map of soil moistures for training areas and indicators of vegetative stress that would cause fire hazards.

Point of Contact

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